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and constructions shown and described, since various other modifications may occur to those with ordinary skill in the art.

IN THE CLAIMS:

1           10. (Twice Amended) DC to DC switching circuit for  
2           controlling power switching devices in a DC to DC converter  
3           having first and second converter circuits operating into a  
4           common load comprising:

5           a first pulse width modulator controlling the power  
6           switching devices of the first converter circuit;

7           a second pulse width modulator controlling the power  
8           switching devices of the second converter circuit;

9           a feedback circuit responsive to the voltage across the  
10          common load;

11          control circuits for controlling the first and second pulse  
12          width modulators responsive to the feedback circuit, the  
13          operation of the first and second pulse width modulators being  
14          interleaved;

15          the control circuits also being responsive to the difference  
16          in currents [current] through the first converter and the second  
17          converter to adjust the relative duty cycle of the first and  
18          second converters to tend to minimize the difference in the  
19          voltage across a sense resistor;

20 the first pulse width modulator, the second pulse width  
21 modulator, the feedback circuit and the control circuits being in  
22 a single integrated circuit.

1 22. (Three Times Amended) A DC to DC converter having a  
2 plurality of converter circuits for operating into a common load,  
3 comprising:

4 a plurality of buck converter circuits operating into the  
5 common load, each buck converter circuit having an inductor for  
6 alternately conducting between the first [and second] power  
7 supply terminal and the common load, [terminals,] and the second  
8 power supply terminal and the common load;

9 a plurality of pulse width modulators driven by a common  
10 oscillator in an interleaved manner, each pulse width modulator  
11 controlling one of the plurality of buck converter circuits,  
12 whereby the operation of the buck converter circuits is  
13 interleaved;

14 a feedback circuit responsive to a voltage across the common  
15 load [output];

16 a voltage control circuit controlling the plurality of pulse  
17 width modulators responsive to the feedback circuit and a  
18 commanded output voltage; and

19 a current balance control circuit responsive to the  
20 difference in currents [current] in the plurality of interleaved  
21 buck converter circuits and controlling the pulse width

22 modulators to balance the currents [current] in the plurality of  
23 interleaved buck converter circuits;

24 the plurality of pulse width modulators and the control  
25 circuits being in a single integrated circuit.

1 32. (Three Times Amended) A DC to DC converter having a  
2 plurality of converter circuits operating into a common load,  
3 comprising:

4 a plurality of buck converter circuits operating into the  
5 common load, each buck converter circuit having an inductor for  
6 alternately conducting between the first [and second] power  
7 supply terminal and the common load, [terminals,] and the second  
8 power supply terminal and the common load;

9 a plurality of pulse width modulators each controlling one  
10 of the plurality of buck converter circuits, the operation of the  
11 pulse width modulators and the buck converter circuits being  
12 interleaved;

13 a feedback circuit responsive to a voltage across the common  
14 load;

15 control circuits responsive to the feedback circuit and a  
16 commanded output voltage to control a nominal duty cycle of the  
17 plurality of buck converter circuits, the control circuits also  
18 being responsive to the difference in currents [current] in the  
19 plurality of interleaved buck converter circuits to adjust [a]  
20 relative duty cycles [cycle] of the plurality of buck converter

21 circuits to balance the currents [current] in the buck converter  
22 circuits;  
23 the plurality of pulse width modulators and the control  
24 circuits being in a single integrated circuit.

1 45. (Three Times Amended) A DC to DC converter having a  
2 plurality of converter circuits operating into a common load,  
3 comprising:  
4 a plurality of buck converter circuits operating into the  
5 common load, each buck converter circuit having an inductor for  
6 alternately conducting between the first [and second] power  
7 supply terminal and the common load, [terminals,] and the second  
8 power supply terminal and the common load;  
9 a plurality of pulse width modulators each controlling one  
10 of the plurality of buck converter circuits, the operation of the  
11 pulse width modulators being interleaved;  
12 control circuits for adjusting a nominal duty cycle of the  
13 plurality of interleaved buck converter circuits, the control  
14 circuits also being responsive to the difference in currents  
15 [current] in the plurality of interleaved buck converter circuits  
16 to adjust the relative duty cycles [cycle] of the plurality of  
17 buck converter circuits to balance the currents [current]  
18 therein;  
19 the plurality of pulse width modulators and the control  
20 circuits being in a single integrated circuit.

1           46. (Twice Amended) A DC to DC converter having first and  
2 second converter circuits operating into a common load,  
3 comprising:

4           first and second buck converter circuits operating into the  
5 common load, each buck converter circuit having an inductor for  
6 alternately conducting between the first [and second] power  
7 supply terminal and the common load, [terminals,] and the second  
8 power supply terminal and the common load;

9           a first pulse width modulator controlling the first buck  
10 converter circuit;

11           a second pulse width modulator controlling the second buck  
12 converter circuit;

13           a feedback circuit responsive to the voltage across the  
14 common load;

15           control circuits for controlling the first and second pulse  
16 width modulators responsive to the feedback circuit;

17           the control circuits also being responsive to current  
18 measurements in the first buck converter circuit and the second  
19 buck converter circuit for adjusting the relative duty cycle of  
20 the first and second pulse width modulators to balance the  
21 currents in the buck converter circuits;

22           the first pulse width modulator, the second pulse width  
23 modulator, the feedback circuit and the control circuits being in  
24 a single integrated circuit.

1 47. (Twice Amended) A DC to DC converter having a  
2 plurality of converter circuits operating into a common load,  
3 comprising:

4 a plurality of buck converter circuits operating into the  
5 common load, each buck converter circuit having an inductor for  
6 alternately conducting between the first [and second] power  
7 supply terminal and the common load, [terminals,] and the second  
8 power supply terminal and the common load;

9 a plurality of pulse width modulators driven by a common  
10 oscillator in an interleaved manner, each pulse width modulator  
11 controlling one of the plurality of buck converter circuits,  
12 whereby the operation of the buck converter circuits is  
13 interleaved;

14 a feedback circuit responsive to a voltage across the common  
15 load;

16 a voltage control circuit for controlling the plurality of  
17 pulse width modulators responsive to the feedback circuit and a  
18 commanded output voltage; and

19 a current balance control circuit responsive to the  
20 difference in currents [current] in the plurality of interleaved  
21 buck converter circuits for controlling the pulse width  
22 modulators to balance the currents [current] in the plurality of  
23 interleaved buck converter circuits;

24 the plurality of pulse width modulators, the feedback  
25 circuit, the voltage control circuit and the current balance  
26 control circuit being in a single integrated circuit.

1 48. (Twice Amended) A DC to DC converter having a  
2 plurality of converter circuits operating into a common load,  
3 comprising:

4 a plurality of buck converter circuits operating into the  
5 common load, each buck converter circuit having an inductor for  
6 alternately conducting between the first [and second] power  
7 supply terminal and the common load, [terminals,] and the second  
8 power supply terminal and the common load;

9 a plurality of pulse width modulators each controlling power  
10 switching devices of one of the plurality of interleaved buck  
11 converter circuits, the operation of the pulse width modulators  
12 and the buck converter circuits being interleaved;

13 a feedback circuit responsive to a voltage across the common  
14 load;

15 control circuits responsive to the feedback circuit and a  
16 commanded output voltage to control a nominal duty cycle of the  
17 plurality of buck converter circuits, the control circuits also  
18 being responsive to the difference in currents [current] in the  
19 plurality of interleaved buck converter circuits to adjust the  
20 relative duty cycles [cycle] of the plurality of buck converter

21 circuits to balance the currents [current] in the buck converter  
22 circuits;

23 the plurality of pulse width modulators, the feedback  
24 circuit and the control circuits being in a single integrated  
25 circuit.

1 49. (Twice Amended) A DC to DC converter having a  
2 plurality of converter circuits operating into a common load,  
3 comprising:

4 a plurality of buck converter circuits operating into the  
5 common load, each buck converter circuit having an inductor for  
6 alternately conducting between the first [and second] power  
7 supply terminal and the common load, [terminals,] and the second  
8 power supply terminal and the common load;

9 a plurality of pulse width modulators each controlling one  
10 of the plurality of buck converter circuits, the pulse width  
11 modulators being driven by a common oscillator signal so that the  
12 operation of the pulse width modulators is interleaved;

13 control circuits for adjusting a nominal duty cycle of the  
14 plurality of interleaved buck converter circuits to control a  
15 voltage on the common load, and for responding to the difference  
16 in currents [current] in the plurality of interleaved buck  
17 converter circuits to adjust the relative duty cycles [cycle] of  
18 the plurality of buck converter circuits to balance the currents  
19 [current] in the buck converter circuits;



20        the plurality of pulse width modulators and the control  
21        circuits being in a single integrated circuit.

1            50. (Twice Amended) A DC to DC converter having first and  
2        second converter circuits operating into a common load,  
3        comprising:

4            first and second buck converter circuits operating into the  
5        common load, each buck converter circuit having an inductor for  
6        alternately conducting between the first [and second] power  
7        supply terminal and the common load, [terminals,] and the second  
8        power supply terminal and the common load;

9            a first pulse width modulator controlling the first buck  
10       converter circuit;

11           a second pulse width modulator controlling the second buck  
12       converter circuit;

13           a feedback circuit responsive to the voltage across the  
14       common load;

15           control circuits for controlling the first and second pulse  
16       width modulators responsive to the feedback circuit;

17           the control circuits also being responsive to current  
18       measurements through the first buck converter circuit and the  
19       second buck converter circuit to adjust the relative duty cycle  
20       of the first and second buck converter circuits;

21 the first pulse width modulator, the second pulse width  
22 modulator and the control circuits being in a single integrated  
23 circuit.

1 51. (Twice Amended) A DC to DC converter comprising:

2 a plurality of buck converter circuits operating into the  
3 common load, each buck converter circuit having an inductor for  
4 alternately conducting between the first [and second] power  
5 supply terminal and the common load, [terminals,] and the second  
6 power supply terminal and the common load;

7 a plurality of pulse width modulators driven by a common  
8 oscillator in an interleaved manner, each pulse width modulator  
9 controlling one of the plurality of buck converter circuits,  
10 whereby the operation of the buck converter circuits is  
11 interleaved;

12 a feedback circuit responsive to a voltage on the common  
13 output;

14 a voltage control circuit for controlling the plurality of  
15 pulse width modulators responsive to the feedback circuit and a  
16 commanded output voltage; and

17 a current balance control circuit for controlling the pulse  
18 width modulators responsive to a difference in currents [current]  
19 in the inductors of the plurality of interleaved buck converter  
20 circuits to balance the currents [current] in the plurality of  
21 interleaved buck converter circuits;

22 the plurality of pulse width modulators and the control  
23 circuits being in a single integrated circuit.

1 52. (Twice Amended) A DC to DC converter having a  
2 plurality of converter circuits operating into a common load,  
3 comprising:

4 a plurality of buck converter circuits operating into the  
5 common load, each buck converter circuit having an inductor for  
6 alternately conducting between the first [and second] power  
7 supply terminal and the common load, [terminals,] and the second  
8 power supply terminal and the common load;

9 a plurality of pulse width modulators each controlling power  
10 switching devices of one of the plurality of buck converter  
11 circuits, the operation of the pulse width modulators and the  
12 buck converter circuits being interleaved;

13 a feedback circuit responsive to a voltage across the common  
14 load;

15 control circuits being responsive to the feedback circuit  
16 and a commanded output voltage to control a nominal duty cycle of  
17 the plurality of buck converter circuits, the control circuits  
18 also being responsive to the difference in currents in the  
19 plurality of interleaved buck converter circuits to adjust the  
20 relative duty cycles [cycle] of the plurality of buck converter  
21 circuits to balance the currents [current] in the buck converter  
22 circuits;

23 the plurality of pulse width modulators and the control  
24 circuits being in a single integrated circuit.

1 53. (Twice Amended) A DC to DC converter having first and  
2 second converter circuits operating into a common load,  
3 comprising:

4 first and second buck converter circuits operating into the  
5 common load, each buck converter circuit having an inductor for  
6 alternately conducting between the first [and second] power  
7 supply terminal and the common load, [terminals,] and the second  
8 power supply terminal and the common load;

9 a first pulse width modulator controlling the first buck  
10 converter circuit;

11 a second pulse width modulator controlling the second buck  
12 converter circuit;

13 a feedback circuit responsive to the voltage across the  
14 common load;

15 control circuits for controlling the first and second pulse  
16 width modulators responsive to the feedback circuit;

17 the control circuits also being responsive to current  
18 measurements in the first buck converter circuit and the second  
19 buck converter circuit to adjust the relative duty cycle of the  
20 first and second buck converter circuits;

21 the first pulse width modulator, the second pulse width  
22 modulator, the feedback circuit and the control circuits being in  
23 a single integrated circuit.

1 54. (Twice Amended) A DC to DC converter having a  
2 plurality of converter circuits operating into a common load,  
3 comprising:

4 a plurality of buck converter circuits operating into the  
5 common load, each buck converter circuit having an inductor for  
6 alternately conducting between the first [and second] power  
7 supply terminal and the common load, [terminals,] and the second  
8 power supply terminal and the common load;

9 a plurality of pulse width modulators driven by a common  
10 oscillator in an interleaved manner, each pulse width modulator  
11 controlling one of the plurality of buck converter circuits,  
12 whereby the operation of the buck converter circuits is  
13 interleaved;

14 a feedback circuit responsive to a voltage across the common  
15 load;

16 a voltage control circuit for controlling the plurality of  
17 pulse width modulators responsive to the feedback circuit and a  
18 commanded output voltage; and

19 a current balance control circuit for controlling the pulse  
20 width modulators to balance the currents [current] in the  
21 plurality of interleaved buck converter circuits responsive to

22 the difference in currents [current] in the plurality of  
23 interleaved buck converter circuits;  
24 the plurality of pulse width modulators, the voltage control  
25 circuit and the current balance control circuit being in a single  
26 integrated circuit.

1 55. (Twice Amended) A DC to DC converter having a  
2 plurality of converter circuits operating into a common load,  
3 comprising:

4 a plurality of buck converter circuits operating into the  
5 common load, each buck converter circuit having an inductor for  
6 alternately conducting between the first [and second] power  
7 supply terminal and the common load, [terminals,] and the second  
8 power supply terminal and the common load;

9 a plurality of pulse width modulators each controlling power  
10 switching devices of one of the plurality of interleaved buck  
11 converter circuits, the operation of the pulse width modulators  
12 and the buck converter circuits being interleaved;

13 a feedback circuit responsive to a voltage across the common  
14 load;

15 control circuits responsive to the feedback circuit and a  
16 commanded output voltage to control a nominal duty cycle of the  
17 plurality of buck converter circuits, the control circuits also  
18 adjusting [a] relative duty cycles [cycle] of the plurality of  
19 buck converter circuits to balance the currents [current] in the

20 buck converter circuits responsive to the difference in currents  
21 [current] in the plurality of interleaved buck converter  
22 circuits;  
23 the plurality of pulse width modulators and the control  
24 circuits being in a single integrated circuit.

1 56. (Twice Amended) A DC to DC converter having a  
2 plurality of converter circuits operating into a common load,  
3 comprising:  
4 a plurality of buck converter circuits operating into the  
5 common load, each buck converter circuit having an inductor for  
6 alternately conducting between the first [and second] power  
7 supply terminal and the common load, [terminals,] and the second  
8 power supply terminal and the common load;

9 a plurality of pulse width modulators each controlling one  
10 of the plurality of buck converter circuits, the pulse width  
11 modulators being driven by a common oscillator signal so that the  
12 operation of the pulse width modulators is interleaved;

13 control circuits for adjusting a nominal duty cycle of the  
14 plurality of interleaved buck converter circuits to control a  
15 voltage on the common load, and for adjusting [a] relative duty  
16 cycles [cycle] of the plurality of buck converter circuits to  
17 balance the currents [current] in the buck converter circuits;  
18 the plurality of pulse width modulators and the control  
19 circuits being in a single integrated circuit.

1 57. (Twice Amended) A DC to DC converter having first and  
2 second buck converter circuits operating into a common load,  
3 comprising:

4 first and second buck converter circuits operating into the  
5 common load, each buck converter circuit having an inductor for  
6 alternately conducting between the first [and second] power  
7 supply terminal and the common load, [terminals,] and the second  
8 power supply terminal and the common load;

9 a first pulse width modulator controlling the first buck  
10 converter circuit;

11 a second pulse width modulator controlling the second buck  
12 converter circuit;

13 a feedback circuit responsive to the voltage across the  
14 common load;

15 control circuits for controlling the first and second pulse  
16 width modulators responsive to the feedback circuit;

17 the control circuits also being responsive to current  
18 measurements in the first buck converter circuit and the second  
19 buck converter circuit to adjust the relative duty cycle of the  
20 first and second pulse width modulators to balance the currents  
21 in the buck converter circuits;

22 the first pulse width modulator, the second pulse width  
23 modulator and the control circuits being in a single integrated  
24 circuit.



1 58. (Amended) A DC to DC converter having a plurality of  
2 converter circuits for operating into a common load, comprising:

3 a plurality of buck converter circuits operating into the  
4 common load, each buck converter circuit having an inductor for  
5 alternately conducting between the first [and second] power  
6 supply terminal and the common load, [terminals,] and the second  
7 power supply terminal and the common load;

8 a plurality of pulse width modulators driven by a common  
9 oscillator in an interleaved manner, each pulse width modulator  
10 controlling one of the plurality of buck converter circuits,  
11 whereby the operation of the buck converter circuits is  
12 interleaved;

13 a feedback circuit responsive to a voltage across the common  
14 output;

15 a voltage control circuit controlling the plurality of pulse  
16 width modulators responsive to the feedback circuit and a  
17 commanded output voltage;

18 the plurality of pulse width modulators and the control  
19 circuits being in a single integrated circuit.

2 60. (Amended) A DC to DC converter having a plurality of  
3 converter circuits operating into a common load, comprising:

4 a plurality of buck converter circuits operating into the  
5 common load, each buck converter circuit having an inductor for

5 alternately conducting between the first [and second] power  
6 supply terminal and the common load, [terminals,] and the second  
7 power supply terminal and the common load;  
8 a plurality of pulse width modulators each controlling one  
9 of the plurality of buck converter circuits, the operation of the  
10 pulse width modulators and the buck converter circuits being  
11 interleaved;  
12 a feedback circuit responsive to a voltage across the common  
13 load;  
14 control circuits responsive to the feedback circuit and a  
15 commanded output voltage to control a nominal duty cycle of the  
16 plurality of buck converter circuits;  
17 the plurality of pulse width modulators and the control  
18 circuits being in a single integrated circuit.

1 62. (Amended) A DC to DC converter comprising:

2 first and second buck converter circuits operating into a  
3 common load, each buck converter circuit having an inductor for  
4 alternately conducting between the first [and second] power  
5 supply terminal and the common load, [terminals,] and the second  
6 power supply terminal and the common load;

7 first and second pulse width modulators driven by a common  
8 oscillator in an interleaved manner, each pulse width modulator  
9 controlling a respective one of the first and second buck

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10 converter circuits, whereby the operation of the buck converter  
11 circuits is interleaved;  
12 a feedback circuit responsive to a voltage across the common  
13 output;  
14 a voltage control circuit controlling the first and second  
15 pulse width modulators responsive to the feedback circuit and a  
16 commanded output voltage;  
17 the plurality of pulse width modulators and the control  
18 circuits being in a single integrated circuit.

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64. (Amended) A DC to DC converter comprising:  
1 first and second buck converter circuits operating into a  
2 common load, each buck converter circuit having an inductor for  
3 alternately conducting between the first [and second] power  
4 supply terminal and the common load, [terminals,] and the second  
5 power supply terminal and the common load;  
6  
7 first and second pulse width modulators each controlling a  
8 respective one of the buck converter circuits, the operation of  
9 the pulse width modulators and the buck converter circuits being  
10 interleaved;  
11 a feedback circuit responsive to a voltage across the common  
12 load;  
13 control circuits responsive to the feedback circuit and a  
14 commanded output voltage to control a nominal duty cycle of the  
15 plurality of buck converter circuits;

16 the plurality of pulse width modulators and the control  
17 circuits being in a single integrated circuit.

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